

Online Learning Experience (OLE) Planning Grid - ITEC 7480 & 7481

Curriculum Standard (applicable to k12 only):

This will be a supplementary, enrichment unit in a CCGPS Pre-Calculus course seeking to integrate historical information about trigonometry with mathematical investigations using interactive web-based tools. Therefore, the standards that inform the unit are from Common Core State Standards for Literacy in History/Social Studies, Science and Technical Subjects and will expand upon the CCGPS Mathematics Standards for Georgia.

Mathematical Standards:

Define trigonometric ratios and solve problems involving right triangles

MCC9-12.G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

MCC9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

MCC9-12.F.TF.9 (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

MCC9-12.G.SRT.10 (+) Prove the Laws of Sines and Cosines and use them to solve problems.

MCC9-12.G.SRT.11 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Literacy Standards: (<http://www.literacyta.com/common-core-standards/standards-english-and-literacy-content-areas>)

1. Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
3. Follow precisely a complex multistep procedure when performing technical tasks; analyze the specific results based on explanations in the text.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Technology Standards: from ISTE (<http://www.iste.org/standards/nets-for-students>)

1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

- a. Apply existing knowledge to generate new ideas, products, or processes
- b. Create original works as a means of personal or group expression
- c. Use models and simulations to explore complex systems and issues

3. Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information.

- a. Plan strategies to guide inquiry
- b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
- c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
- d. Process data and report results

4. Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

- a. Identify and define authentic problems and significant questions for investigation
- b. Plan and manage activities to develop a solution or complete a project
- c. Collect and analyze data to identify solutions and/or make informed decisions
- d. Use multiple processes and diverse perspectives to explore alternative solutions

Student Objectives/Outcomes:	Bloom's Level:	Activities:	Assessments:
1. <i>Given a list of required elements and suggested websites, students will create a visual representation of the historical development of trigonometry, using web-based tools.</i>	<i>Synthesis</i>	<ul style="list-style-type: none"> Students will create a timeline of historical developments in trigonometry using web-based resources such as http://nrich.maths.org/6843&part= http://nrich.maths.org/6853&part= http://nrich.maths.org/6908&part= http://www-groups.dcs.st-andrews.ac.uk/~history/ 	<ul style="list-style-type: none"> <i>Timeline created using online web tools such as:</i> http://www.tiki-toki.com/ http://www.capzles.com/timeglider.com http://www.dipity.com/ http://www.preceden.com/ <i>Students will present their results to the class</i> <i>(Still thinking about the format for presentations because there will not be class time available. Students may create screencasts of their timelines and post them to a website or to Edmodo and be required to provide</i>

			<i>critiques to five other students)</i>
2. Students will use online mathematical software (Geogebra, Desmos or other apps) to investigate and verify between five and eight conjectures or theorems by mathematicians from their timelines. Students will prove 3 of the conjectures/theorems using analytic techniques.	Evaluation	<ul style="list-style-type: none"> Students will create files of geometric sketches that verify the historical conjecture. Students will write formal proofs of 3 of the theorems. Resources: http://wiki.geogebra.org/en/Main_Page http://wiki.geogebra.org/en/Manual:Main_Page iTunesU Geogebra GeogebraTube video tutorials http://geogebrawiki.wikispaces.com/GB+GeoGebra+Tutorials Math and Multimedia Geogebra Tutorials	<ul style="list-style-type: none"> Geogebra files Proofs
3. Students will investigate Ptolemy's Theorem and produce a replication of his table of chords. They will compare the accuracy of these approximations to values of the sine function and analyze the error. They will plot the results for angles between 0 and $\frac{\pi}{2}$ radians and discuss the results using appropriate mathematical language and terminology.	Application Analysis Evaluation	<ul style="list-style-type: none"> Online investigation of Ptolemy's Theorem Creation of spreadsheet containing Ptolemy's chord lengths, values of the sine, error analysis Scatterplot comparing Ptolemy's results and values of the sine http://www.artsofliberty.org.vhost.zerolag.com/sites/default/files/PTOLEMY%20DAY%206_1.pdf http://www.artsofliberty.org.vhost.zerolag.com/sites/default/files/PTOLEMY%20DAY%207_1.pdf http://www.artsofliberty.org.vhost.zerolag.com/sites/default/files/PTOLEMY%20DAY%208_1.pdf YouTube video tables in Desmos Creating tables in Desmos	<ul style="list-style-type: none"> Each component of the assignment will be assessed for accuracy
4. Students will investigate and explain the algorithms used by calculators (Taylor Series and CORDIC algorithm) to evaluate the sine and cosine functions	Application Synthesis	<ul style="list-style-type: none"> Written explanation of the two algorithms Taylor Series algorithm http://www.marypat.org/stuff/nylife/010206.html Maclaurin Series Algorithm http://www.intmath.com/series-expansion/3-how-calculator-works.php CORDIC Algorithm http://en.wikipedia.org/wiki/CORDIC http://dspguru.com/dsp/faqs/cordic	<ul style="list-style-type: none"> Multimedia presentation of how a calculator computes the sine and cosine of any angle
5. Students will compare Ptolemy's Theorem to the modern day sum and difference identities for the sine and cosine	Application Analysis	<ul style="list-style-type: none"> Students will prove the sum and difference identities for sine, cosine and tangent using a dynamic sketch Students will solve problems using sum and difference identities 	<ul style="list-style-type: none"> Written, problem-solving assessment, in class.

**Copy grid as many times as necessary to organize a 6-8 week learning experience.*